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Review Article

Emerging heat-related climate change influences; a public health challenge to health care practitioners and policy makers: Insight from Bulawayo, Zimbabwe

Bigboy Ngwenya*, Jacques Oosthuizen, Martyn Cross, Kwasi Frimpong

Edith Cowan University, Perth, Australia

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ABSTRACT

Current climate trends of extreme temperature and humidity during summer present a public health dilemma in Zimbabwe and other developing countries. National and local governments have defined roles to protect the health of populations under their jurisdictions as stipulated in relevant policies. The involvement of public health practitioners in policy development and management of heat-related illnesses is vital for the protection of the public, particularly vulnerable groups. The current role of health providers in developing countries regarding climate change impacts on health is considered suboptimal. Focus group interviews with public health practitioners and policy makers in the city of Bulawayo in Zimbabwe showed that officials lacked knowledge and awareness regarding heat-related impacts on health, particularly in relation to differences in individual susceptibility and currently employed heat adaptation and coping mechanisms.

1. Introduction

The frequency of hot day temperatures in Zimbabwe is increasing and previous study have shown that from 1955 to 2003 the frequency of hot days increased by 1.86% per decade compared to the global average of 0.89% [1]. Worldwide average surface temperatures as assessed by the International Panel on Climate Change are projected to increase by between 1.8 and 4.0 °C by 2100 [6]. The latest assessment of average global temperatures by the International Panel on Climate Change [7] concluded that more extreme high temperatures will impact land areas more often. These predicted changes will impact on humans in numerous ways, particularly those who are poor, elderly or suffering from ill health. Climate change is likely to have a significant impact on people in developing countries located in the tropics, which presents a challenge to governments who are striving to preserve the highest standard of health attainable for their populations, as required by the United Nations Human Rights Council [16].

It has been predicted that estimated global temperatures will increase by 2–4 °C over the next decades [1]. The World Health Assembly identified four climate change priorities for countries, which include: (1) assessing the scale and nature of health vulnerability, (2) development and implementation of health protection and promotion strategies, (3) decision making support, enhanced surveillance and monitoring capacity and (4) assessments of financial and other resources aimed at health protection [17]. Current studies concur that heat-related illnesses will emerge as major health issues in the future, particularly in developing countries such as Zimbabwe. Literature shows that heat waves occur more frequently than any other natural hazard of late, yet they are not generally recognised as significant hazards and causes of mortality, particularly in developing countries [9]. There is a lack of research on heat stress and heat-related illness in developing countries generally and in Zimbabwe specifically. The current trend of heat waves during summer exposes the population to heat-related health risks and the population acknowledges the situation has changed over the last 5 years. Climate change research in Zimbabwe has focused on health issues such as malaria and water borne diseases; however, no studies to date have investigated the issues of emerging heat stress on humans.

Heat is a naturally occurring hazard associated with climate change and it needs to be captured in policy development as a health issue. Heat waves are responsible for a significant proportion of human mortality [18]. In Zimbabwe, there is a lack of evidence to assess the impact of heat on mortality or morbidity as the link between environmental heat and health records has not been established.

Globally, it has been shown that many people are frequently exposed to stressful heat environmental conditions that exceed the capacity of normal human physiological coping mechanisms, thus placing such individuals at risk of suffering heat stress-related illnesses or could

* Correspondence to: 107 Yindana Boulevard, Lakelands, WA 6180, Australia.
E-mail address: b.ngwenya@ecu.edu.au (B. Ngwenya).

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potentially result in increased mortality [8]. Zimbabwe along with most other sub Saharan countries in Africa is facing an increase in the frequency of hot summer days caused by climate change.

The present study measured ambient temperatures in Bulawayo during the summer of 2015 and the study period included two-week long heat waves. The first occurred during October where the average daily temperature was 32 °C coupled with high humidity levels and the second was during November when some days reached 38 °C. This situation in Zimbabwe creates a dilemma amongst a large sector of the population who spend long hours working outdoors under direct sunlight. Their exposure to heat could impact on their health directly by causing heat-related illnesses or indirectly via food spoilage, which could cause food poisoning and increased exposure to dust. The groups that are most vulnerable to heat exposure include the elderly, children, displaced individuals, those with chronic diseases, low socio-economic status and people employed in outdoor occupations [10,19,3].

Socio-economic factors contribute to the extent of the problem as the health status of this vulnerable sector of society is not well monitored and many people cannot afford access to medical help due to their economic situation. The problem is further exacerbated by the fact that the same cohort live in housing with poor ventilation and limited access to air conditioning, or have unstable electricity supply. In addition, the health impacts of heat on these individuals are not reported. The city of Bulawayo was Zimbabwe's industrial hub in the 1980s; however, due to an economic meltdown, industries closed and many workers were retrenched. According to the 2012 census, the city's population comprises of 653,337 inhabitants (303,346 males and 349,991 females). Unemployment is exceptionally high and is estimated to be equal to 80%; however, this is better than the national rate of 85% [13]. Much of the unemployed population have found alternative means of self-sustenance, working as street vendors (hawkers), often in direct sunlight, without any protection. Street vendors are a group of the population that sell goods, fruits and vegetables, new and second hand clothes and other items either in push carts or stalls or with their goods spread out on the sidewalks in Bulawayo. This vulnerable population consist of various cross sections of society, which include the poor, elderly, children and young adults, many of whom have completed secondary and even tertiary education but are unable to secure work. This sector of society is ill-equipped to cope with increasing temperatures and their choices are limited. The Zimbabwean situation is further impacted by evidence of perennial droughts, floods, hail storms, more water-related diseases, hot days and heat waves that impact the already fragile agro-based economy, natural resources, livestock production and the wellbeing of the population [2].

Monitoring the risk of heat stress and health impacts among vulnerable populations is emerging as a critical concern in public health [12,5,8]. The situation in most developing countries is compounded by a lack of knowledge amongst the general population and health professionals regarding the impacts of heat stress and heat exposure and its management. The present study discovered that heat stress-related effects on humans is a new occurrence in developing countries, which is not yet considered an issue. Lack of policy considerations regarding heat exposure mitigation highlights issues that underscore the management of heat-related effects [11,15].

Environmental health officers (EHOs) who are responsible for the management of environmental health-related issues in Zimbabwe are not aware of the extent of the problem and they are not empowered to take action to mitigate the effects of climate change on health. The effective management of heat waves requires a consultative approach with all stakeholders working together to make decisions that might influence policy changes towards minimising heat-related hazards. According to Huang et al. [4], developing countries should advance appropriate adaptive capacity building and adaptation implementation engagement with vulnerable populations to minimise heat stress impacts. Various preventive measures to reduce morbidity and mortality associated with heat stress should include early warning systems, as well as health promotion and improved working conditions for outdoor workers including the provision of adequate shade and ventilation, as well as access to cool sources of hydration. Other strategies include acclimatisation, use of fans, influencing behavioural change patterns, building design improvements and improved urban planning [12,4]. Some of these strategies would be difficult for Zimbabwe to achieve due to its economic situation. In Zimbabwe, EHOs employed by national and local governments are ideally placed to take a lead in the monitoring of heat, development of heat management plans and the education of communities on the effects of heat exposure [14].

Whilst health professionals have a duty to work towards the fulfillment of the rights of communities to good health and to manage and protect human health within their jurisdictions, this is difficult to define in heat-related situations in Bulawayo [16]. In Zimbabwe, health workers, other advocacy groups and government agencies need to collaborate and develop policies that guide public health action aimed at adaptation strategies to cope with climate change. More research and public awareness on climate change and related health impacts are required, especially in the developing world in tropical regions such as Zimbabwe.

The present study explored the knowledge and awareness of health providers and policy makers regarding climate change health effects, programs, projects and policies aimed at mitigating heat-related health impacts. These findings are intended to be utilised to raise awareness of the role of public health professionals and policy makers in preparing vulnerable communities to adapt to and cope with extreme heat events in the future. The findings might trigger or influence the development of appropriate policies towards heat prevention.

2. Methodology

Qualitative data was gained from 25 participants from 2 focus group discussions. These groups were representative of the health systems management in the country and their inputs provide robust results of the Zimbabwean situation. One group (n = 15) comprised civil servants responsible for health services provision, which included EHOs, technicians, health promotion officers, public health officers and nurse practitioners. The second group (n = 10) comprised city councillors who had been elected into office by the Bulawayo residents from different political parties and their backgrounds were varied in terms of education and expertise in health issues. This city has a smaller management team, who represent a range of different disciplines such as health, education, engineering, housing, town planning, law and administration.

Participants were recruited one month in advance via the chairpersons of committees and convenient times and locations for the focus group discussions were negotiated. Interviews were conducted during October and November 2015. The meeting with health services providers was conducted at the Health Services Department board room, while the focus group for policy makers was conducted at a venue in the Bulawayo City Hall. Prior to the commencement of interviews, participants were issued with information letters that included the research proposal, approval letters from Bulawayo City Council and the human research ethics committees of both the Medical Research Council of Zimbabwe and Edith Cowan University, Australia. All participants also signed consent forms.

The focus group discussions were guided by a pre-determined set of questions that were utilised to gain information on health workers and policy makers understanding of heat exposure and adaptation strategies employed by vulnerable groups in urban Bulawayo. The focus group discussions covered the following categories: current policies and regulations related to heat stress, promotion of adaptation strategies, heat stress management and health promotion programs. Participants were asked to give their own recommendations on how heat effects in Zimbabwe could be managed. All sessions were audio recorded, with prior permission, and notes were taken during discussions.

To correlate focus group discussion results, quantitative measurements of the temperature and relative humidity were undertaken during the summer (September to November) using data logging heat stress monitors manufactured by Lascar Environmental & Scientific Test Instruments (Lascar heat monitors).

2.1. Data analysis

The audio recorded and transcribed notes were analysed. Grounded theory was applied to analyse all data, which were grouped and coded into categories that addressed the research objectives. These were reviewed by the researcher and re-rated by two health promotion officers for reliability. Emerging themes were identified and examined from concepts maps and flow charts. The Lascar heat monitor readings strengthened the group discussion findings.

3. Results

Focus group participants acknowledged that global warming and extreme weather was caused by climate change and that local weather patterns had changed over the last five years. The effects of climate change were being felt by the population in Zimbabwe, particularly those working out in the open. Floods were noted as becoming more frequent and were affecting the health and livelihood of the population, especially those in the agricultural economy. All participants admitted that the country had no heat stress prevention policies and there were no risk and disaster management plans designed to deal with this issue.

Two main themes emerged from the group discussions. The first theme focused on the heat situation, public health and susceptibility, and the second theme focused on knowledge and awareness.

3.1. Theme 1: Heat situation, public health and susceptibility

The participants from both groups agreed that the heat experienced over the most recent years in Bulawayo had greatly increased and was affecting the health of the population particularly those who spend long hours in the heat, such as street vendors. The groups acknowledged that the population in Bulawayo was now exposed to abnormal temperatures ranging from 29 °C to above 40 °C, which is aggravated by high humidity during summer. There has been gradual increase of temperatures from the usual 24 °C to 28 °C Lascar heat monitor results verified the experience of street vendors was within the same temperature range of 35 °C to 38 °C accompanied by high humidity ranges, particularly during two heat waves that were experienced in October and November 2015. Heat impact is becoming a public health concern; however, there are no mitigation strategies across the country to cope with such conditions. The participants also revealed a public health dilemma since there were no existing policies and procedures that addressed heat stress management and prevention at a local or national level. The two groups recognised that Bulawayo and, in fact, the whole country, had no strategy of managing heat effects and there were no action plans in place. The present study concludes that risk reduction might be overlooked in planning and integrating the responsibilities of both the national and local authorities in civil protection and public health responsibilities.

Following a week-long heat wave during November 2015, one participant in the group said,

> Definitely after last week's heat wave, we really need specific policies for heat management, I never saw the reason why I will go around carrying a bottle of water, I have seen people carrying water bottles around the city and have said it's just people who want to be seen as important, but I am not the same anymore, I now know what it means to be dehydrated (Male – 60 +).

This demonstrates that the hazard exposure is becoming a reality to the communities who have to find their own coping strategies without protection of rights.

The participants from the health services provider group also acknowledged that the *Factories Act* (national legislation) covered the health and safety of industry workers in Zimbabwe. However, informal industries that include street hawkers and vendors were not covered by this Act, although they have been recognised by the government as an industry. There are no government agencies with defined roles to enforce laws on heat stress prevention. EHOs stated that in the past they monitored air pollution in the city. However, the Environmental Management Authority took over the role following legislation changes. The air monitoring equipment owned by the city was said to be obsolete and environmental heat or its impact on the population has never been monitored. Participants accepted that Bulawayo City Council by-laws did not cover heat stress prevention. The council vending (street hawking) by-laws were for operation of vending, not operating, conditions and, therefore, do not include heat management. For this reason, there is evidence of institutional incapacity and acknowledgement to deal with risk.

One participant from this group said,

> The failure by EHOs to conduct environmental monitoring that includes climate change effects like heat exposure, will have great consequences to the public health field. Staff need resources and appropriate training to deal with the new envisaged crisis (Female – 30 +).

Both groups emphasised that legal street hawking involved the issuing of licences to individuals by councils to operate businesses selling fruits and vegetables, new and second-hand clothes and products was managed effectively by the council when the economy was stable. More recently due to the unemployment crisis, vending is now “everyone's business” and it is difficult for councils to manage this informal sector population, due to a lack of resources and political factors. The legally licensed hawkers of Bulawayo are provided with shelters, drinking water and toilets, yet the majority of hawkers are now unlicensed and hence are not catered for and not provided with essential requirements. Focus group participants agreed that unlicensed street hawkers were deemed to be the most vulnerable group likely to be impacted by extreme heat events. The participants agreed that illegal street hawkers were generally poor, from lower socio-economic groups, under-nourished and some have underlying chronic diseases. This vulnerable group comprise the elderly or very young children who spend long hours of the day selling their wares in the open, under direct sunlight with no access to shade, water or any means of cooling themselves. The councillors argued that the current economic and political situation in the country had a bearing on the development of crucial policies such as heat prevention policies as no politician is keen to make policy decisions for fear of losing votes at the local and national level. The present study also found that EHOs were not trained adequately to monitor heat stress, which was accompanied by privation of resource provisions. Politics and the economic situation were observed to hinder the management of those affected by extreme summer heat in Bulawayo. Observations revealed that there is no control over those working on the street pavements, leading to their indiscriminate movement across the city and risk of unmonitored heat stress and other health effects. Although they engage in distribution of services, their situation is extremely hazardous. Climate change leaves these vulnerable groups exposed to extreme heat without any adaptive and coping measures in place.

3.2. Theme 2. Knowledge and awareness

Participants from both groups were aware of climate change and they attributed this phenomenon to air pollution and its impact on the atmospheric ozone layer. Their understanding brings some knowledge gap in understanding the relationship of the ozone hole and climate change. They also identified climate change-related effects such as the

Table 1
Assessment of heat-related issues by health practitioners and policy makers.

	Health practitioners n = 15		Policy makers n = 10		
	Yes	No	Yes	No	Not sure
Heat waves have increased in the last five years in the city of Bulawayo?	15 (100%)	0	10 (100%)	0	0
Are there existing specific heat stress prevention policies in Zimbabwe?	0	15 (100%)	0	6 (60%)	4 (40%)
Are there heath communication programs that extend to vulnerable groups including street hawkers on heat stress adaptation?	0	15 (100%)	0	10 (100%)	0
Are there processes of monitoring and evaluating the impacts of heat stress trends and mortality rates in the city?	0	15 (100)	0	0	10 (100%)
Is the population knowledgeable about heat-related illnesses?	0	15 (100%)	0	10 (100%)	0

current prevalence of cyclones, floods and abnormally hot and humid weather conditions. This was evident from the EHOs who had some knowledge of environmental monitoring. Participants agreed that currently the Zimbabwe Meteorological Department informs the public via the Zimbabwe Broadcasting Corporation about climate change and issue warnings about floods. However, not a lot was being undertaken about informative warnings for heat events. One participant said, "judging from this year's high temperatures, the government has to come up with policies and strategies to protect the public, people have no knowledge about heat-related illnesses" (Female – 33).

All participants established that education programs need to be developed to enlighten the population about the dangers of spending long hours in the sun without protective means. Health education content programs for managing heat-related illnesses should be developed for health workers and the general population. Another participant from the health professionals said,

> As health services department, we have never trained our staff on heat stress or heat-related illnesses, all trainings are nationally driven and funded, e.g. under the national health agenda and through the data we provide nationally. Health statistics is done by the Ministry of Health and heat stress is not on the top ten or it may be under diagnosed or miss-diagnosed, if it's diagnosed then it is not recorded or there is lack of knowledge amongst the health personnel. I am not confident that our staff can diagnose and manage it competently (Male – 50).

This evidence shows a gap in managing heat-related cases, including morbidity and mortality in Zimbabwe.

The participants also acknowledged that Bulawayo city was a member of the civil protection committee, which is called upon to discuss any form of emergency. However, the multi-sectoral committee has never discussed heat-related emergencies, probably due to a lack of knowledge and awareness on the issue or factors of resources and burden of the prevailing situation in terms of responsibilities.

The group members revealed that heat-related illnesses are being felt by a larger sector of the population. One EHO said,

> Of late, a number of schools under my work areas have complained about students having heat rashes and fainting. On investigations, I realised students also had heat burns, but science teachers refused that its sun burn and were not keen for the students to be referred to the clinic for further checks (Male – 46 +).

This shows the gap in knowledge amongst some teachers as a group of professionals who should be imparting knowledge on heat stress prevention to children and the public.

The focus group participants accepted that climate change effects as observed over the previous summer were a cause for concern for the health delivery system and policy development. Another participant from the policy makers said,

> When you look at the number of people who are in the informal sector jobs and how scattered they are, the facilities like water provisions and clinics are not near them, in the event of heat wave disaster, I don't think as Bulawayo City we could be able to ferry all these people to the health centres, they will just die in front of us (Female – 50 +).

This is evident that the city's disaster prevention systems were not strong enough to manage a situation of high magnitude or disaster.

Council EHOs said that even if they were provided with temperature monitoring equipment, they were not trained and equipped to conduct the monitoring properly. The participants agreed that as heat stress prevention is a new phenomenon in Zimbabwe, the government and local authorities need to take steps to engage in education and awareness programs for the general population as a preventive measure in case of heat wave disasters or as risk reduction strategies.

Regarding the assessment of heat-related issues, 100% of the focus group participants revealed that Bulawayo was facing an increase of heat waves (Table 1), which indicates that some of the population who undertake outdoor work might be at risk of heat stress. However, some policy makers (40%) who were councillors were unsure of the existence of policies specific to heat prevention as well as environmental monitoring processes. Councillors were not aware of temperature monitoring processes or evaluation techniques for morbidity and mortality rates as shown in Table 1 (100%).

3.3. Risk factors

The participants who were implementers and policy makers highlighted the current economic situation as a crisis that would have greater effects on public health in the future. They agreed that more than half of the working population of Bulawayo are now operating businesses in open streets, which is exposing them to high temperatures. Street vending has become their current source of livelihood. These people are susceptible to heat stress without any mitigation strategies in place. The other group mentioned by the participants as susceptible were the hard to reach or homeless people who are socially isolated and who were also viewed as individuals with low health literacy. These groups of vulnerable people will bear the brunt of climate change-related impacts. One of the participants said,

> All the vulnerable groups have a lack of knowledge of the heat-related illnesses, just like us the policy makers and furthermore the outdoor workers spend long hours in the sun, as street hawking is their only source of making a living in current years" (Female – 50).

All participants concurred that the risks to susceptible groups will increase due to the current economic situation in Bulawayo and the whole country will be aggravated by the limited preventive capacity of the relevant government agencies to reduce these risks. There was also a lack of information dissemination on adaptive heat prevention strategies generally at all levels. Vulnerable people need to be educated and informed about the risks of heat exposure as a matter of priority in the lead up to summer and strategies that can be employed to mitigate heat-related effects need to be identified and implemented.

4. Discussion and conclusion

The present study identified that increasing heat waves in Bulawayo, Zimbabwe create concern for the long-term health of the population, which includes a significant proportion of vulnerable people. The study explored observations and levels of understanding of health workers and policy makers regarding the health risks associated with heat waves and the public health impact and susceptibility of the population to heat waves. Specific heat-related prevention policies were also explored. It was determined that neither the Zimbabwe Government nor the city of Bulawayo had heat stress prevention policies and heat-related illnesses were not reported by the Ministry of Health or any other stakeholder groups. This indicates that there are both knowledge, resources and commitment gaps on the part of the country in managing the emerging public health issues of health-related illnesses and deaths due to climate change. The participants accepted that climate change was not embraced as having an impact on human health and the emphasis of climate change was believed to be centred on water resources and agriculture.

There is a lack of policy direction that is inclusive of human health heat effects. Health professionals in Zimbabwe need to be involved in defining the scale and impact of climate change in humans, with a focus on heat stress as a new emerging threat to health. All stakeholders, including politicians, non-government organisations, representatives of the outdoor informal sector workers and government departments should be involved in the development and implementation of health protection policies and the design of appropriate strategies that encompass all population groups. National and local governments must allocate resources to deal with the emerging public health climate change predicament. All stakeholders should provide political change both in national and local governments towards managing heat stress emanating from climate change. In the current economic situation in Zimbabwe, health providers should utilise monitoring records from the Meteorological Department to predict heat stress and develop community health heat prevention education programs. As part of a multisectoral approach, media houses should be involved in information dissemination at both the local and national level.

The findings of the present study showed that Zimbabwe has a National Climate Change Response Strategy that is uncoordinated and crosses over into different government sectors and policies, which creates problems for implementation. Whilst this strategy acknowledges the effects of climate change particularly in the agricultural sector, natural resources, livestock production and water related diseases, heat-related illnesses and mortality is not covered. There is no government department that is fully responsible for managing the strategy, thus heat stress prevention is not covered and the population is left at risk. The Ministry of Health's input in the National Climate Change Response Strategy on heat-related effects is not evident as a priority and has thus been overlooked. The socio-economic situation in Bulawayo also reflects the political conditions that show the non-existence of institutional capacity to plan and implement risk reduction strategies related to heat wave events and heat stress prevention.

The study found gaps in knowledge and awareness levels on heat-related illnesses amongst health practitioners and policy makers who were also operating without heat focused policies. Health providers showed further knowledge gaps in heat-related illness diagnosis and management. Health providers, climate change experts and advocacy groups need to develop information and guidance materials that will influence politicians to work towards the development of heat prevention policies. Although some participants had attended disaster management committee meetings, heat-related emergencies had not been covered. Climate change and health ministries should provide expertise and guidance to the disaster management committees in heat risk reduction strategies. Heat and human health-related capacity building should be developed for the multi-stakeholder disaster management committees to help them cope with emerging heat waves in Zimbabwe. The present study might increase the knowledge level of policy makers and public health practitioners and help them work together to develop policy interventions aimed at the protection of vulnerable populations against heat stress at a municipality level. The findings of the present study might also trigger health practitioners' involvement in climate change issues and research more broadly.

The focus group participants acknowledged that there was a lack of Bulawayo city and government tangible initiatives around climate change and heat-related public health issues. There were no campaigns conducted by the Ministry of Health and its health partners that focused on heat emergencies. This outlines significant knowledge gaps among both health providers and the general population. Both focus groups expressed the need for specific awareness on heat stress to cover all groups, in particular vulnerable sectors of the population. The participants recommended that the government should develop heat-related policies, with a focus on the informal industry sector, in an effort to improve human health heat effects associated with climate change. It was also recommended that all health workers should be trained and educated in heat-related illnesses, along with public health messaging. EHOs should be trained in monitoring climate change health effects, including temperature monitoring. Furthermore, it was recognised that the government and local authorities including Bulawayo city should develop strategies for heat prevention, adaptation, mitigation and community educational programs to address their human rights duties. Heat management guidelines should be developed to protect the population and vulnerable groups, which should include developing designated vending sites in the city and providing sheds for shelter and access to water. Comprehensive education programs on climate change and heat-related issues should also be developed to target schools, tertiary institutions and health departments as well as the general public. The programs should emphasise plenty of water intake during hot weather, appropriate light weight clothing, wearing floppy hats, applying sunscreens, and monitoring high-risk groups such as children, the elderly, those with chronic illnesses and homeless people for hot weather health emergencies such as heat stroke and heat exhaustion.

5. Limitations

The present study was restricted to 2 focus groups whose 25 members were health professionals employed by Bulawayo city and their policy makers, with emphasis on the effect of heat stress on street vendors in Bulawayo city. The study did not include other health providers from the private sector or other policy makers and government departments also based in Bulawayo. The inclusion of more vulnerable groups would perhaps have strengthened the study and permitted greater insight on the subject of discussion. However, these were restrictions dictated by the scope of the present study.

6. Future research

It is important that public health departments and the various related health providers employ evidence based research to assist with their public health programing to mitigate the effects of climate change and heat stress. Research based training and development of relevant health messages for different health providers will help promote climate change adaptation and reduce heat stress-related effects of vulnerable groups and the population at large. It is recommended that further research should focus on health policy development to manage climate change and the associated human health effects such as heat stress management, particularly for developing countries and the impact on the general population.

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